

REMARKS/ARGUMENTS

Claims 1-30 are pending in the present application. No claims were canceled, amended, or added. Reconsideration of the claims is respectfully requested.

I. 35 U.S.C. § 102. Anticipation: Claims 1-4, 8, 11-14, 18, 21-24 and 28

The Examiner has rejected claims 1-4, 8, 11-14, 18, 21-24 and 28 under 35 U.S.C. § 102 as being anticipated by Lowry, Apparatus for Synthesizing Speech by Varying Pitch, U.S. Patent No. 5,787,398, July 28, 1998 (hereinafter "Lowry"). This rejection is respectfully traversed.

The Office Action states:

Regarding claims 1, 11 and 21, Lowry discloses a method, computer program product and a data processing system, hereinafter referenced as a method comprising:

filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters (vocal tract components of a waveform; column 3, lines 8-22), wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples (frame of fixed length; column 5, lines 13-21);

determining from the residual signal frame at least one pitch cycle within the residual frame (at least two per pitch period; column 3, lines 25-35);

applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles (re-form the desired speech signal; column 3, lines 36-51); and

synthesizing a second speech signal from the modified residual frame and the set of vocal tract model parameters (modified pitchmark to resynthesize speech from the residual; column 5, lines 2-6), whereby the second speech signal is a pitch-compensated speech signal (to give more consistent results; column 5, lines 24-35 and column 6, lines 15-25).

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A prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. *In re Bond*, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). All limitations of the claimed invention must be considered when determining patentability. *In re Lowry*, 32 F.3d 1579, 1582, 32 U.S.P.Q.2d 1031, 1034 (Fed. Cir. 1994). Anticipation focuses on whether a claim reads on the product or process a prior art reference discloses, not on what the reference broadly teaches. *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 U.S.P.Q. 781 (Fed. Cir. 1983).

Independent claim 1, which is representative of independent claims 11 and 21 with regard to similarly recited subject matter, recites:

1. A method comprising:
 - filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters, wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples;
 - determining from the residual signal frame at least one pitch cycle within the residual frame;
 - applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles; and
 - synthesizing a second speech signal from the modified residual frame and the set of vocal tract model parameters, whereby the second speech signal is a pitch-compensated speech signal.

Independent claim 1 recites the feature of "filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters, wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples." (emphasis added). The Office Action points to column 5, lines 13 through 21 of Lowry, which is reproduced below for the Examiner's convenience, as teaching this feature:

The LPC analysis may be performed using any of the conventional methods, when using covariance or stabilized covariance method, each set of LPC parameters would be obtained for a section of the speech portion (analysis frame) of length equal to the pitch period (centered on the midpoint of the pitch period rather than on the pitch mark), or alternatively longer, overlapping sections might be used which has the advantage of permitting the use of an analysis frame of fixed length according to pitch.

Lowry, column 5, lines 13 through 21.

The above cited reference does not teach "wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples." Instead the above cited passage of Lowry teaches use of an analysis frame that is of fixed length. However, a fixed length analysis frame is not the same thing as the frame of the first speech signal and the residual signal frame containing a same fixed number of samples. Instead the passage merely teaches that the analysis frame alone is of a fixed length. The above cited passage of Lowry does not teach that residual frame contains the same fixed number of samples as the frame of the first speech signal.

Additionally claim 1 recites the feature of "applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles." The Office Action points to Lowry, column 3, lines 36 through 51, reproduced below for the Examiner's convenience, as teaching this feature:

With short frame lengths, the stabilized covariance method would be preferable in terms of accuracy. With the longer frames used here, no perceptual difference is

observed between the three methods, so the autocorrelation method is preferred as it is computationally efficient and guaranteed to give a stable synthesis filter.

Having determined the LPC parameters, the next step is to inverse filter the speech on a pitch-synchronous basis. As mentioned above, the parameters are interpolated to minimize transients due to large changes in parameter values at frame boundaries. At the center of each pitch period, the filter corresponds exactly to that obtained from the analysis. At each sampling instant between successive period centers, the filter is a weighted combination of the two filters obtained from the analysis. Preferably the interpolation is applied directly to the filter coefficients.

Lowry, column 5, lines 36 through 51.

The above cited passage of Lowry does not teach the feature of "applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles." While the above cited passage teaches modifying a residual frame by using a transformation function, nowhere does the passage teach "wherein the modified residual frame contains an integer number of pitch cycles." In fact, the above cited passage does not teach anything about pitch cycles or about a modified residual frame containing an integer number of pitch cycles.

Thus, in view of the above, Lowry fails to teach each and every feature of claim 1. Thus, the Lowry reference fails to anticipate claims 1, 11, and 21.

Therefore, for all the reasons set forth above, Applicants submit that independent claims 1, 11, and 21 are not taught by the Lowry reference. Claims 2-4, 8, 12-14, 18, 22-24, and 28 are dependent claims, depending from independent claims 1, 11, and 21. Applicants have already demonstrated claims 1, 11, and 21 to be in condition for allowance. Applicants respectfully submit that claims 2-4, 8, 12-14, 18, 22-24, and 28 are also allowable, at least by virtue of their dependency on allowable claims.

Therefore, the rejection of claims 1-4, 8, 11-14, 18, 21-24 and 28 under 35 U.S.C. § 102 has been overcome.

II. 35 U.S.C. § 103, Obviousness: Claims 6-7, 10, 16-17, 20, 26-27 and 30

The Examiner has rejected claims 6-7, 10, 16-17, 20, 26-27 and 30 under 35 U.S.C. § 103 as being unpatentable over Lowry in view of Chuang, Speech Recognition Using Preclassification and Spectral Normalization, U.S. Patent No. 4,941,178, July 10, 1990 (hereinafter "Chuang"). This rejection is respectfully traversed.

The Office Action states:

Regarding claim 6, 16 and 26, Lowry discloses a method wherein the speech signal is pitch-compensated, but does not specifically teach wherein the transformation function changes the time scale of the residual signal by performing a non-linear time warping operation on an interval of the residual signal so as to find a correspondence

between samples from the interval of the residual signal and samples in a reference signal.

Chuang teaches speech recognition using preclassification and spectral normalization wherein the transformation function changes the time scale of the residual signal by performing a non-linear time warping operation (the dynamic time warp technique performs a nonlinear time sequence adjustment) on an interval of the residual signal so as to find a correspondence between samples from the interval of the residual signal and samples in a reference signal (to bring it into closer match; column 6, lines 8-18)) to carry out phonetic preclassification.

Therefore, it would have been obvious to one ordinary skilled in the art at the time the invention was made to modify Lowry's method wherein the transformation function changes the time scale of the residual signal by performing a non-linear time warping operation on an interval of the residual signal so as to find a correspondence between samples from the interval of the residual signal and samples in a reference signal, as taught by Chuang, to carry out phonetic preclassification, since words can be spoken at different rates, one can not expect that the slope vectors will match the prototype exactly over time (column 6, lines 8-18).

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The Lowry reference still does not teach all the claim limitations in claims 1, 11, and 21, as argued above in section I, regarding the rejection of claim 1. As claims 6-7, 10, 16-17, 20, 26-27 and 30 depend from claims 1, 11, and 21, the same distinctions between the Lowry reference and claims 6-7, 10, 16-17, 20, 26-27 and 30 exist.

Furthermore, Chuang does not cure the deficiencies of Lowry. Chuang does not teach the features missing from Lowry, including "filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters, wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples," and "applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles," nor does the Examiner cite to any portion of Chuang that teaches these features.

Thus, claims 6-7, 10, 16-17, 20, 26-27 and 30 are patentable over the cited references because the combination of the Lowry reference with the Chuang reference would not teach the presently claimed invention. The features relied upon as being taught in the Lowry reference are not taught or suggested by that reference, as explained above. Chuang does not cure the deficiencies of Lowry. As a result, a combination of these references would not teach the claimed invention as recited in claims 6-7, 10, 16-17, 20, 26-27 and 30.

In view of the above, Applicants submit that dependent claims 6-7, 10, 16-17, 20, 26-27 and 30 are not taught or suggested by Lowry or Chuang. Claims 6-7, 10, 16-17, 20, 26-27 and 30 are dependent claims depending on independent claims 1, 11, and 21. Applicants have already demonstrated claims 1,

11, and 21 to be in condition for allowance. Applicants respectfully submit that claims 6-7, 10, 16-17, 20, 26-27 and 30 are also allowable, at least by virtue of their dependency on allowable claims.

Therefore, the rejection of claims 6-7, 10, 16-17, 20, 26-27 and 30 under 35 U.S.C. § 103 has been overcome.

III. 35 U.S.C. § 103. Obviousness: Claims 9, 19 and 29

The Examiner has rejected claims 9, 19 and 29 under 35 U.S.C. § 103 as being unpatentable over Lowry in view of Moriya et al., Coding Method and Coder for Coding Input Signals of Plural Channels Using Vector Quantization, and Decoding Method and Decoder Therefore, U.S. Patent No. 5,651,090, July 22, 1997 (hereinafter "Moriya"). This rejection is respectfully traversed.

The Office Action states:

Regarding claims 9, 19 and 29, Lowry discloses a method wherein the speech signal is pitch-compensated, but does not specifically teach a method comprising cyclically shifting samples in the modified residual signal frame so as to normalize a phase of the modified residual signal frame.

Moriya teaches a coding method wherein it comprises cyclically shifting samples in the modified residual signal frame so as to normalize a phase of the modified residual signal frame (normalized residual coefficients are cyclically shifted (column 19, lines 1 - 15), to suppress a pitch component.

Therefore, it would have been obvious to one ordinary skilled in the art at the time the invention was made to modify Lowry's method wherein it comprises cyclically shifting samples in the modified residual signal frame so as to normalize a phase of the modified residual signal frame, as taught by Moriya, to provide flattened fine structure coefficients (column 28, lines 13-32).

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The Lowry reference still does not teach all the claim limitations in claims 1, 11, and 21, as argued above in section I, regarding the rejection of claim 1. As claims 9, 19 and 29 depend from claims 1, 11, and 21, the same distinctions between the Lowry reference and claims 9, 19 and 29 exist.

Furthermore, Moriya does not cure the deficiencies of Lowry. Moriya does not teach the features missing from Lowry, including "filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters, wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples," and "applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles," nor does the Examiner cite to any portion of Moriya that teaches these features.

Thus, claims 9, 19 and 29 are patentable over the cited references because the combination of the Lowry reference with the Moriya reference would not teach the presently claimed invention. The features

relied upon as being taught in the Lowry reference are not taught or suggested by that reference, as explained above. Moriya does not cure the deficiencies of Lowry. As a result, a combination of these references would not teach the claimed invention as recited in claims 9, 19 and 29.

In view of the above, Applicants submit that dependent claims 9, 19 and 29 are not taught or suggested by Lowry or Moriya. Claims 9, 19 and 29 are dependent claims depending on independent claims 1, 11, and 21. Applicants have already demonstrated claims 1, 11, and 21 to be in condition for allowance. Applicants respectfully submit that claims 9, 19 and 29 are also allowable, at least by virtue of their dependency on allowable claims.

Therefore, the rejection of claims 9, 19 and 29 under 35 U.S.C. § 103 has been overcome.

IV. 35 U.S.C. § 103, Obviousness: Claims 5, 15 and 25

The Examiner has rejected claims 5, 15 and 25 under 35 U.S.C. § 103 as being unpatentable over Lowry in view of Laroia et al., Speech Coder Methods and Systems, U.S. Patent No. 5,839,098, November 17, 1998 (hereinafter "Laroia"). This rejection is respectfully traversed.

The Office Action states:

Regarding claims 5, 15 and 25, Lowry discloses a method wherein the transformation function changes the time scale of the residual signal by performing operations that include:

selecting a set of samples from the residual signal, wherein the set of samples is a consecutive sequence of samples taken from the residual signal (consecutive), such that the set of samples corresponds to a contiguous interval of time in the residual signal (column 4, lines 40-47), but does not specifically teach performing linear interpolation between samples in the first set of samples so as to model the residual signal over said contiguous interval of time as a piecewise linear function and generating the modified residual signal by generating a new sequence of samples from the piecewise linear function such that the cardinality of the new sequence of samples is equal to the same fixed number of samples as contained in the residual signal frame.

Laroia discloses a method to identify pitch pulses (column 7, lines 13-22) by performing linear interpolation between samples in the first set of samples (linear interpolation; column 9, lines 4-16) so as to model the residual signal over said contiguous interval of time as a piecewise linear function (piecewise linear function; column 9, lines 38-43); and

generating the modified residual signal by generating a new sequence of samples from the piecewise linear function such that the cardinality of the new sequence of samples is equal to the same fixed number of samples (frames of fixed numbers) as contained in the residual signal frame (column 6, lines 25-62), to improving speech.

Therefore, it would have been obvious to one ordinary skilled in the art at the time the invention was made to modify Lowry's method wherein it performs linear interpolation between samples in the first set of samples so as to model the residual signal over said contiguous interval of time as a piecewise linear function and generates the modified residual signal by generating a new sequence of samples from the piecewise linear function such that the cardinality of the new sequence of samples is equal to the same fixed number of samples as contained in the residual signal frame, as taught by

Laroia, to enhance the characterization for producing an improved perceptual accuracy in corresponding synthesized speech (column 4, lines 14-18).

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The Lowry reference still does not teach all the claim limitations in claims 1, 11, and 21, as argued above in section I, regarding the rejection of claim 1. As claims 5, 15 and 25 depend from claims 1, 11, and 21, the same distinctions between the Lowry reference and claims 5, 15 and 25 exist.

Furthermore, Moriya does not cure the deficiencies of Lowry. Laroia does not teach the features missing from Lowry, including "filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters, wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples," and "applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles," nor does the Examiner cite to any portion of Laroia that teaches these features.

Thus, claims 9, 19 and 29 are patentable over the cited references because the combination of the Lowry reference with the Laroia reference would not teach the presently claimed invention. The features relied upon as being taught in the Lowry reference are not taught or suggested by that reference, as explained above. Laroia does not cure the deficiencies of Lowry. As a result, a combination of these references would not teach the claimed invention as recited in claims 5, 15 and 25.

In view of the above, Applicants submit that dependent claims 5, 15 and 25 are not taught or suggested by Lowry or Laroia. Claims 5, 15 and 25 are dependent claims depending on independent claims 1, 11, and 21. Applicants have already demonstrated claims 1, 11, and 21 to be in condition for allowance. Applicants respectfully submit that claims 5, 15 and 25 are also allowable, at least by virtue of their dependency on allowable claims.

Therefore, the rejection of claims 5, 15 and 25 under 35 U.S.C. § 103 has been overcome.

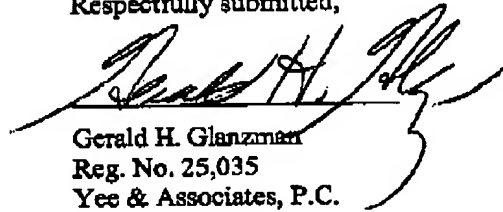
V. Conclusion

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance.

The Examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the Examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

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Respectfully submitted,



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